

**COORDINATING COMMISSION
FOR POSTSECONDARY EDUCATION**

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PROPOSAL FOR NEW INSTRUCTIONAL PROGRAM
Form 92-40

SECTION I

Institution Submitting Proposal: University of Nebraska-Lincoln

Title of Program: Bachelor of Science in Software Engineering

CIP Code: 14.0903

Organizational Unit in which program will be located:

Department of Computer Science and Engineering
College of Engineering

Name of contact person in the event additional information is needed: Dr. Susan M. Fritz

Telephone: 402-472-5242

Degree, Diploma, or Certificate to be offered (use separate submittal for each level):

Bachelor of Science in Software Engineering

Proposed date to initiate program: When approved by the Coordinating Commission

List the location(s) where this program will be offered: UNL

If the program has a projected ending date, please so indicate:

Date approved by Governing Board: March 18, 2016

(Attach all documents related to this proposal upon which the Governing Board made its decision to approve the proposal.)

Chief Executive Officer's or other Authorized Officer's signature: _____


Susan M. Fritz

Proposal to Create a Major in Software Engineering

I. Descriptive Information

Name of Institution Proposing the Program: University of Nebraska-Lincoln

Name of the Major Proposed: Software Engineering

Degrees/Credentials to be Awarded: Bachelor of Science in Software Engineering

Other Undergraduate Programs Offered in This Field by University of Nebraska: None. (The UNO College of Information Science and Technology offers an integrated undergraduate/masters degree program with a concentration in Software Engineering.)

CIP Code: 14.0903

Administrative Units for the Program: The UNL Department of Computer Science and Engineering within the College of Engineering will administer the program.

Proposed Delivery Site and Type of Delivery: University of Nebraska-Lincoln campus

Date Approved By Governing Board: TBD

Proposed Date the Program will be Initiated: Upon final approval

Description and Purpose of the Proposed Program:

Software Engineering is the study and application of the rigorous engineering practices required to specify, architect, develop, analyze, test, and maintain software systems. Its importance as a field of study and practice has increased significantly as software systems have grown in size, complexity and pervasiveness. Software Engineering goes beyond programming, i.e., writing code, to ensure software systems are constructed to satisfy the many requirements that customers define for them, that they behave correctly, reliably and efficiently, and that they are affordable to maintain.

Software Engineers serve in both technical and management roles. They generally work as part of a larger team, and often serve as a bridge between the business units and the software systems engineering staff. Working closely with technical specialists, e.g., application developers and database analysts, and with business specialists, e.g., managers, business analysts, and clients, Software Engineers help organizations build and maintain software systems of all sizes. They analyze user needs for new systems and changes to existing software. They also design, architect and construct software systems and make changes to systems to fix defects and add new features. Software engineers are also responsible for testing and verifying software for correctness and other features.

In 2012, over one million software engineers were employed in the US, and a faster than average growth rate (22%) is projected through 2022 for jobs requiring bachelor-level degrees in software development [2]. Nebraska, and Lincoln in particular, have recently witnessed a sharp rise in the demand for more highly skilled software developers. According to the 2013 Bureau of Labor and

Statistics OES survey, the employment rates for Software System Developers in Lincoln was up 12%, and 8% for Software Application Developers over the past three years [3].

Originally a field within Computer Science, Software Engineering has evolved to become a field in its own right, applying both computing and engineering principles to the creation and maintenance of high-quality software systems in a systematic, controlled and efficient manner. The two key professional organizations, IEEE and ACM, emphasize the need for degree programs in Software Engineering and specify different model curricula for each. In May 2004, ACM and IEEE first issued a joint report on a model curriculum for developing undergraduate degree programs in Software Engineering. The report was recently updated to reflect an improved understanding of the discipline of software engineering as it has evolved over the last ten years [1]. Furthermore, ABET, the key organization responsible for accrediting engineering programs, recognizes Software Engineering as a separate engineering discipline and has established accreditation guidelines for it.

The topics covered by Software Engineering are diverse and include many of the same topics as the field of Computer Science, but with a greater emphasis on the software development process. The IEEE Guide to Software Engineering Body of Knowledge [4] divides Software Engineering into 15 Knowledge Areas: (1) Software Requirements, (2) Software Design, (3) Software Construction, (4) Software Testing, (5) Software Maintenance, (6) Software Configuration Management, (7) Software Engineering Management, (8) Software Engineering Process, (9) Software Engineering Models and Methods, (10) Software Quality, (11) Software Engineering Professional Practice, (12) Software Engineering Economics, (13) Computing Foundations, (14) Mathematical Foundations, and (15) Engineering Foundations.

Although many of the software engineering topics can be (and are) briefly covered in the one-semester Software Engineering course offered by most Computer Science programs, it is not possible to provide the depth of coverage necessary to adequately prepare students for a career as a software engineer.

To support Nebraska industry and remain at the forefront of engineering disciplines, it is important for the College of Engineering at the University of Nebraska-Lincoln to establish an undergraduate program in Software Engineering that will provide students with a strong foundation in computer science, math, and software engineering, to enable them to become effective software engineers and to lead software engineering efforts. The UNL Department of Computer Science and Engineering is uniquely positioned to deliver this program due to its concentration of world-class Software Engineering scholars¹.

The coursework for the proposed major in Software Engineering (Bachelor of Science in Software Engineering) at UNL consists of 124 credit hours of study. Seventy-nine hours cover core Computer Science and Software Engineering courses: 52 hours of required coursework (shown below in Table A), 15 hours of technical electives, and 12 hours of a two-year capstone course sequence which provides students with hands-on experience on multiple real-world projects while being mentored by Computer Science and Engineering faculty.

¹ Cumulative data from Ren and Taylor's 2007 Communications of the ACM article "Automatic and versatile publications ranking for research institutions and scholars" places UNL's group in the top-5 in the world.

Table A: Required Computer Science and Software Engineering Courses (52 hours)

Course Number	Title	Credits	Development
SOFT 160	Software Engineering I	4	New course
SOFT 161	Software Engineering II	4	New course
SOFT 260	Software Engineering III	4	New course
SOFT 261	Software Engineering IV	4	New course
SOFT 360	Software Engineering Mentoring and Leadership	1	New course
SOFT 461	Advanced Topics in Software Engineering	3	Existing course*
SOFT 466	Software Design and Architecture	3	New course
SOFT 467	Testing, Verification and Analysis	3	New course
SOFT 468	Requirements Elicitation, Modeling and Analysis	3	New course
CSCE 10	Introduction to CSE	0	Existing course
CSCE 230	Computer Organization	4	Existing course
CSCE 235	Introduction to Discrete Structures	3	Existing course
CSCE 322	Programming Language Concepts	3	Existing course
CSCE 378	Human-Computer Interaction	3	Existing course
CSCE 411	Data Modeling for Systems Development	3	Existing course
CSCE 423	Design and Analysis of Algorithms	3	Existing course
CSCE 451	Operating Systems Principles	3	Existing course
CSCE 491	Internship in Computing Practice	1	Existing course

**SOFT 461 will be cross-listed with existing course CSCE 461 to avoid naming conflicts with the new Software Engineering course, SOFT 161.*

As an information-based engineering discipline, the proposed software engineering major also requires students to complete 18 hours of coursework in mathematics and 12 hours of science course work, of which at least one science course must include a laboratory. In contrast to physics-based engineering disciplines, the training of Software Engineers calls for a background in mathematics to help them organize and process representations that characterize potentially large corpuses of data. For this reason, student mastery of techniques from discrete mathematics, linear algebra, probability and statistics is essential. To accommodate courses on these topics, the proposed curriculum eliminates requirements for upper level calculus and differential equations (though they can still be taken as electives). Software Engineering majors take an additional 15 hours of coursework to satisfy Achievement-Centered Education (ACE) institutional objectives. All Software Engineering majors are required to take a 1 credit hour (paid or unpaid) internship.

Admission requirements for the major in Software Engineering are the same as the admission requirements for the College of Engineering at the University of Nebraska-Lincoln. Once students are admitted to the College, students must go through the Professional Admission Process, which is automatically performed for qualifying students at the end of the sophomore year. In order to be considered for Professional Admission to the Software Engineering program, students must receive at least a C+ in SOFT 160, SOFT 161, SOFT 260, SOFT 261, CSCE 235, MATH 106 and MATH 107 (or their equivalents), and have a GPA of at least 2.5 (semester and cumulative). Table B shows a sample 4-year plan for a student majoring in Software Engineering under the proposed program.

Table B: Sample Program of Study for the Software Engineering Major

First Semester		Credits	Second Semester		Credits
SOFT 160: Software Engineering I		4	SOFT 161: Software Engineering II		4
CSCE 10: Introduction to CSE		0	CSCE 235: Discrete Structures		3
MATH 106: Calculus I		5	MATH 107: Calculus II		4
Natural Sciences course		4	Natural Sciences course with Lab		4
ACE Student Learning Outcome 5 course		3			
Total		16	Total		15
Third Semester		Credits	Fourth Semester		Credits
SOFT 260: Software Engineering III		4	SOFT 261: Software Engineering IV		4
CSCE 378: Human-Computer Interaction		3	CSCE 322: Programming Language Concepts		3
ENGR 20: Sophomore Engineering Seminar		0	CSCE 451: Operating Systems Principles		3
Natural Sciences course		4	MATH 314: Linear Algebra		3
CSCE 230: Computer Organization		4	STAT 380: Statistics and Applications		3
Total		15	Total		16
Fifth Semester		Credits	Sixth Semester		Credits
CSCE 493: Innovation Lab Project		3	CSCE 493: Innovation Lab Project		3
CSCE 411: Data Modeling for Systems Development		3	SOFT 461: Advanced Topics in Software Engineering		3
CSCE 423: Design and Analysis of Algorithms		3	SOFT 466: Software Design and Architecture		3
Math/Statistic Elective course		3	CSCE/SOFT Technical Elective course		3
JGEN 200: Technical Communication I		3	CSCE/SOFT Technical Elective course		3
SOFT 360: Software Engineering Mentoring and Leadership		1	CSCE 491: Internship in Computing Practice		1
Total		16	Total		16
Seventh Semester		Credits	Eighth Semester		Credits
CSCE 486: Computer Science Professional Development		3	CSCE 487: Computer Science Senior Design Project		3
SOFT 467: Testing, Verification and Analysis		3	SOFT 468: Requirements Elicitation, Modeling and Analysis		3
ACE Student Learning Outcome 6 course		3	ACE Student Learning Outcome 7 course		3
CSCE/SOFT Technical Elective course		3	ACE Student Learning Outcome 9 course		3
CSCE/SOFT Technical Elective course		3	CSCE/SOFT Technical Elective course		3
Total		15	Total		15

Several schools in the Big Ten conference offer a *graduate* degree program in Software Engineering or a Software Engineering certificate, or they offer a focus area in Software Engineering for students pursuing an undergraduate degree in Computer Science. Other schools have a strong research presence in Software Engineering. None of the Big Ten schools, however, offer an undergraduate degree program in Software Engineering. Similarly, although UNO does not offer an undergraduate program in Software Engineering, they do offer a set of graduate-level courses covering fundamental and advanced principles in software development to support a concentration in software engineering in their Integrated Undergraduate/Graduate program. Table C summarizes the Software Engineering programs at the Big Ten institutions.

Table C: Software Engineering Presence in Big Ten Schools

School	Software Engineering Presence
University of Illinois at Urbana-Champaign	Software Engineering certificate in Computer Science undergraduate program. Strong Software Engineering research presence.
Indiana University	M.S. in Human-Computer Interaction (a sub-field of Software Engineering).
University of Iowa	Software Engineering focus area in Computer Science undergraduate program.
University of Michigan	No Software Engineering programs.
Michigan State University	Strong Software Engineering research presence.
University of Minnesota	M.S. in Software Engineering. Strong Software Engineering research presence.
Northwestern University	No Software Engineering programs.
The Ohio State University	Software Engineering focus area in Computer Science undergraduate program. Strong Software Engineering research presence.
Pennsylvania State University	Online M.S. in Software Engineering.
Purdue University	Software Engineering track in Computer Science undergraduate program. Strong Software Engineering research presence.
University of Wisconsin-Madison	No Software Engineering programs.

The University of Nebraska-Lincoln will be the first Big Ten school and the first school in Nebraska to offer a baccalaureate program in Software Engineering that is taught by one of the top academic software engineering research groups in the world who also have over a decade of experience in delivering project-centered software engineering training in the Raikes School of Computer Science and Management.

II. Review Criteria

A. Centrality to Role and Mission of the Institution

The proposed program is consistent with the expectations of the business community, the plans of the College of Engineering, and the strategic plan of UNL. The proposed Software Engineering program will offer an academic major with high salary potential and much faster than average growth rate in job opportunities [2]. It will combine the latest best practices in research-based instructional methods with hands-on experience through real-world projects, classroom interactions and internships with industry partners in order to provide students with the education

and training most needed by software engineers to support Nebraska industry. The proposed program complements the existing Computer Science and Computer Engineering programs offered by the University of Nebraska by educating students on the engineering aspects of developing and maintaining evolving complex software systems.

B. Evidence of Need and Demand

1. Need for the Software Engineering Program

In recent decades, the number of software engineering job opportunities has grown to such an extent that industry has been forced to hire individuals with little or no formal training in software development. The need for graduates who are skilled in the foundations and modern practice of design, construction, and maintenance of large software-intensive systems is substantial and is projected to increase over the coming decades as software becomes increasingly more prevalent, and more complex systems are developed. Nebraska, and Lincoln in particular, have recently witnessed a sharp rise in the demand for more highly skilled software developers. According to the 2013 Bureau of Labor and Statistics OES survey, the employment rates for Software System developers in Lincoln was up 12%, and 8% for Software Application Developers over the past three years [3], and the projected *annual* job openings in Nebraska for Software Application Developers is estimated at 160 over the next seven years [3].

The proposed software engineering curriculum will educate and train Software Engineering majors to apply rigorous software engineering practices and principles and will prepare students to serve in key industry roles such as systems analysts, software architects, quality assurance engineers, application developers, systems software developers, user interface designers, software project managers, and software development managers. An entry-level software engineer earns on average \$71,262 annually [5]. Table D shows the median annual pay, number of jobs, and projected growth rate for several employment titles that a software engineer may have, as reported by the U.S. Department of Labor, Occupational Outlook Handbook (2014-15 Edition).

Table D: Employment Statistics from the U.S. Department of Labor

Title	Median Annual Pay in 2012	Number of Jobs in 2012	Projected Growth Rate 2012-2022
Systems Software Developer	\$99,000	405,000	20%
Application Software Developer	\$90,060	613,000	23%
Computer Systems Analyst	\$79,680	520,600	25%
Programmer	\$74,280	343,700	8%
Computer and Information System Managers	\$120,950	332,700	15%

Although software engineers are often employed by companies whose business products are software or software services, they are also employed by a wide range of Nebraska-based firms whose primary business objective is not software, but instead, manufacturing, insurance, information processing, etc.

Examples of Nebraska-based companies in which software engineering plays a vital role in their success include: *Sandhills Publishing, Hudl, Design Data, Fiserv, Kiewit Corporation, Professional Research Consultants, Firespring, Pen-Link, Nebraska Global, Opendorse, Nelnet, Centrix Solutions,*

Zillow, VM Innovations, Stone Fin Technology, Software Technology Inc., Information Analytics, and Chronic Care Solutions. Our discussions with leadership in each of these companies indicates a strong desire for more and better software engineering education on their part and letters from these companies, in Appendix A, attest to their support for the proposed curriculum.

The proposed Software Engineering major will build on the many strong partnerships that already exist between the UNL Department of Computer Science and Engineering and Nebraska companies, as well as new partnerships. As the letters of support in Appendix A illustrate, Nebraska industry support for the new program is strong and our industry partners are willing to get involved to help create an innovative program that will help address the acute shortage of software engineers and contribute to Nebraska economic growth. Several excerpts taken from the letters of support illustrate the level of support and commitment from these companies:

Doug Durham, Principle & CTO for Nebraska Global states that the proposed program is *“not only a game-changer for our local community but has the potential to differentiate UNL CSE from every other CSE program across the country...I believe the approach you are taking with this program is not only novel, but could disrupt how people view higher education’s approach to training software engineers.”* He adds *“I am looking forward to rolling up my sleeves and helping you get this program launched and successful.”*

And, Kris Lappala, Chief Information Officer at Kiewit Corporation states *“This four-year software engineering program would be a significant help to meet the growing demand we face in filling key roles across our organization. We are regularly looking for quality candidates, especially with the unemployment rate for technologists in the region at less than 1%...A program at the University of Nebraska-Lincoln would help alleviate our challenges and cultivate excellent talent that we can develop at our strong companies in our state.”*

We have also solicited feedback on the proposed program from the Computer Science and Engineering Industry Advisory Panel, and from various organizations during site visits. The response has been overwhelmingly positive, and management at every organization has pledged to support the program through hands on time with the students, e.g., facilities tours, internships, and guest lectures to share state-of-the-practice techniques and processes.

2. Demand for the Program

Fueled by a strong job market for technology specialists to develop and maintain large software systems, recent years have seen an increased demand for Software Engineering programs. The increasing numbers of student inquiries during campus visits, comments from current students, and other information gathered by academic advisors indicates strong interest in a Software Engineering major. Enrollment in the UNL Department of Computer Science and Engineering is up 65% from 2011, indicating strong demand from students for a computing education. While we anticipate that a Software Engineering major may cause some of our current students to change majors to the new program, it is expected that most of the students will be new students who otherwise would not have selected UNL for their undergraduate studies. Students in Nebraska as well as students in several metropolitan centers located not far from UNL, e.g., Kansas City and Denver, are prime candidates for this program since they do not currently have access to a Software Engineering program locally. Based on discussions with the Raikes School, we also believe the program will be appealing to many of their students who already receive training in software engineering practices as part of the Design Studio course.

The proposed Software Engineering program will be attractive to students seeking an innovative and experience-based curriculum. Existing Software Engineering programs largely follow a computer science curriculum that is extended to also train students in the Software Engineering Body of Knowledge – an ISO/IEC international standard that defines the essential knowledge of a skilled practicing software developer. Many of the programs operate out of institutions with a long history of cooperative education programs, where students spend a significant amount of time working in industry to reinforce their knowledge and skills. Our investigation into these programs reveals innovation in the mid-2000s, but a tendency towards stagnation due, in part, to curricula that were not designed to be easily updated and, as a result, have not kept pace with the many rapid advances in software engineering principles and practices. Many of these programs have also not taken full advantage of recent advances in instructional methodologies. The proposed Software Engineering program at UNL will address student demand for an innovative and experience-based curriculum by leveraging our top-ranked Software Engineering faculty, and over a decade of experience in delivering project-centered software engineering education and training in the Raikes School. The proposed program will combine the latest best practices in research-based instructional methods with hands-on experience through real-world projects and internships. Leveraging state-of-the-art equipment and facilities, the new Software Engineering program will deliver the foundations and skills necessary to prepare students to engineer large-scale software systems.

Based on available information, the number of students expected to enroll in the program is 38-42 students per cohort after the initial years as shown in Table E. The minimum number of students to make the program viable is 25 students per cohort. The estimates are expected to vary within 10% to account for dropouts and transfers, and we fully expect more students to be interested in the program once it is established based on the limited supply of qualified software engineers and the demand from industry. To expand the program to allow enrollments to grow beyond the numbers shown in Table E will require additional investments in the program for faculty, TA support and physical resources.

Table E: Projected Enrollment Figures in the Proposed Program

Year 1 2016-2017	Year 2 2017-2018	Year 3 2018-2019	Year 4 2019-2020	Year 5 2020-2021
29	69	109	149	160

C. Adequacy of Resources

Based on current and planned resources, the Software Engineering Program is designed to graduate approximately 40 students per year once it is fully implemented.

1. Faculty and Staff Resources

The Department of Computer Science and Engineering currently has five Tenure track faculty associated with the Software Engineering program: Matthew Dwyer, Gregg Rothermel, Sebastian Elbaum, Myra Cohen, and Witty Srisa-an, and one Professor of Practice faculty, Suzette Person, who is the Director of the Software Engineering program. The Department also has one vacant Tenure track faculty position in the Software Engineering group (recently vacated by Anita Sarma). We expect to fill this position by the start of the new program (in addition to the new faculty hires discussed below).

With the new Software Engineering major, the CSE department will shift offerings of advanced undergraduate SE courses from the CS and CE curriculum to the new SE curriculum. This will redirect the undergraduate teaching capacity of the current SE faculty, mentioned above, to align with the delivery of the SE curriculum. Additional teaching needs for the SE curriculum will be met with new hires.

Three additional faculty positions (two Tenure track and one Professor of Practice) are planned to support the new program. Average course load for Tenure track faculty is three courses per year. The average course load for a Professor of Practice is six courses per year. Four additional Graduate Teaching Assistant (GTA) positions are also planned and two new staff FTEs (one to support the capstone course and one to provide systems administration support for the new program). Beyond these positions, support for additional faculty lines, teaching assistants, and support staff would be demonstrated through student enrollment in the major, and credit hour production. Administrative support for the program will be handled through existing personnel supported by the Department of Computer Science and Engineering.

2. Physical Facilities

The Software Engineering program will be delivered on the UNL campus. The Department of Computer Science and Engineering utilizes the classroom space in Avery Hall as well as other buildings on campus. No additional physical space is currently required.

3. Instructional Equipment and Informational Resources

No additional instructional equipment or informational resources is required to support the program as described in the proposal. Students in the program will be required to lease, own, or have access to a laptop for use in the classroom throughout their course of study.

4. Budget Projections

Budget projections for the first five years of the program are shown in Tables 1 and 2. Projected expenses include new faculty, GTAs and staff. Revenue sources include funding received from the UNL Senior Vice Chancellor for Academic Affairs (SVCAA) and expected tuition and fees from increased enrollment and differential tuition. Refer to the footnotes in each table for an explanation of the projections.

TABLE 1: PROJECTED EXPENSES - Bachelor of Science in Software Engineering

	FY 2016 Year 1			FY 2017 Year 2			FY 2018 Year 3			FY 2019 Year 4			FY 2020 Year 5			Total Cost
	FTE	Cost		FTE	Cost		FTE	Cost		FTE	Cost		FTE	Cost		
Personnel¹																
Faculty ²	3	\$338,400		3	\$348,552		3	\$359,009		3	\$369,779		3	\$380,872		\$1,796,612
Professional	0			0			0			0			0			\$0
Graduate assistants ³	2	\$56,668		2	\$58,368		4	\$120,892		4	\$124,876		4	\$129,012		\$489,816
Support staff ⁴	1	\$58,500		2	\$164,255		2	\$169,183		2	\$174,258		2	\$179,486		\$745,682
Subtotal	6	\$453,568		7	\$571,175		9	\$649,083		9	\$668,913		9	\$689,370		\$3,032,109
Operating																
General Operating ⁵		\$15,000			\$15,000			\$15,000			\$15,000			\$15,000		\$75,000
Equipment																\$0
New or renovated space																\$0
Library/Information Resources																\$0
Other																\$0
Subtotal		\$15,000			\$15,000			\$15,000			\$15,000			\$15,000		\$75,000
Total Expenses		\$468,568			\$586,175			\$664,083			\$683,913			\$704,370		\$3,107,109

¹Yearly personnel expenses are increased by 3% annually for years 2-5 from the year 1 baseline.

²Funds to hire two Assistant Professors (estimated starting salary \$90K-\$95K) and one Assistant Professor of Practice (estimated starting salary \$72K-\$76K), plus benefits. In addition to the new hires, the current SE faculty allocate a portion of their teaching capacity to the new program, e.g., offerings of SE courses in CS and CE will be reduced and that capacity directed to this new SE degree program.

³ Hire two Graduate Teaching Assistants (GTAs) to support in-class lab-based instruction, an additional two GTAs will be hired as the program builds out.

⁴Hire an entry level computing staff member to exclusively support undergraduates (laptop setup, infrastructure, etc.). In year 2, hire a staff member to support the capstone courses required during Junior and Senior years of program.

⁵Operating budget will be used for recruiting, outreach, industry programs, and day-to-day operations specific to the new Software Engineering program.

TABLE 2: REVENUE SOURCES FOR PROJECTED EXPENSES - Bachelor of Science in Software Engineering

	FY2016 Year 1	FY2017 Year 2	FY2018 Year 3	FY2019 Year 4	FY2020 Year 5	Total
Allocated UNL Funds for CSE ¹	\$395,068	\$ 406,920	\$ 419,128	\$ 431,701	\$ 444,653	\$2,097,470
Required New Public Funds						
1. State Funds						
2. Local Tax Funds (community colleges)						
Gross Tuition/Gross Differential Tuition ²	\$404,131	\$990,884	\$1,600,945	\$2,235,012	\$2,456,358	\$7,687,330
Other Funding						
Total Revenue	\$799,199	\$1,397,804	\$2,020,073	\$2,666,714	\$2,901,010	\$9,784,800

¹UNL's Senior Vice Chancellor for Academic Affairs has allocated funds for one Asst. Professor of Practice position, two new Asst. Professor hires, and two Teaching Assistants. Yearly personnel expenses are increased by 3% annually for years 2-5 from the year 1 baseline. As program growth requires, additional hires will be supported with college tuition and differential tuition allocations.

² Gross tuition estimates are based on the table below.

Projected Tuition Revenue												
Student Type ¹	Year 1		Year 2		Year 3		Year 4		Year 5			
	R	N	R	N	R	N	R	N	R	N	R	N
Estimated Gross Tuition ²	\$8,693.44	\$25,584.69	\$8,867.31	\$26,096.38	\$9,044.65	\$26,618.31	\$9,225.55	\$27,150.68	\$9,410.06	\$27,693.69		
Estimated Enrollment ³	29		69		109		149		160			
Est. Enrollment by Type	20	9	47	22	74	35	101	48	108	52		
Estimated Gross Tuition	\$173,868.75	\$230,262.19	\$416,763.39	\$574,120.39	\$669,304.28	\$931,640.81	\$931,780.09	\$1,303,232.40	\$1,016,286.08	\$1,440,071.80		
Est. Total Gross Tuition Revenue	\$404,130.94		\$990,883.78		\$1,600,945.09		\$2,235,012.49		\$2,456,357.89			

Est. 5 Year Gross Tuition Revenue

\$7,687,330.18

¹ R=Resident, N=Non-Resident

² Tuition estimates include differential tuition for CSCE and SOFT courses; annual tuition increases of 2% are used for years 2-5.

³ Expected steady state enrollment, by year 5, is 160 students (40 in each class).

D. Avoidance of Unnecessary Duplication

The proposed program will be the first Bachelor of Science degree program in Software Engineering offered in the State of Nebraska. UNO, UNK and UNL all offer a bachelors degree in Computer Science, but each institution has developed a unique set of programs that build on synergies with their local community.

The UNO College of Information Science & Technology offers a diverse set of bachelors degrees that provide foundational knowledge in computing and that connect computing to disciplines whose progress can be accelerated by its application. UNO offers degrees in: *Computer Science*, *MIS* (emphasizing computing in the context of a business or organization), *Bioinformatics* (emphasizing computing for the life sciences), *Information Assurance* (emphasizing privacy and security in modern software and networked systems), and *IT* (combing training in core Computer Science and MIS with disciplinary expertise and innovation). These offerings create valuable ties to UNMC, through bioinformatics, and to STRATCOM, through information assurance, for example. Although the UNO College of Information Science & Technology does not offer a bachelors degree in software engineering, they do offer a set of graduate-level courses covering fundamental and advanced principles in software development to support a concentration in software engineering in their Integrated Undergraduate/Graduate program.

UNK's Department of Computer Science & Information Technology offers bachelors degrees in: *Computer Science* and *IT* (blending computing knowledge with applied training in systems administration, security, and web-based systems). The UNK IT program is tailored to provide experts for businesses in central Nebraska that have a strong need for well-rounded IT professionals.

The UNL Department of Computer Science and Engineering seeks to complement its existing *Computer Science* and *Computer Engineering* degree programs by leveraging its highly-regarded software engineering research faculty and its unique position as the only computing department in an Engineering college in Nebraska, to offer a state-of-the-art Software Engineering degree program with a strong engineering emphasis. The proposed program will be unique in that it will be the only SE degree program in the country that:

1. Teaches an "SE first" approach to computing, i.e., it emphasizes the system context and engineering team as the setting within which computing principles are taught,
2. Requires multiple year-long project experiences,
3. Integrates state-of-the-practice knowledge, delivered by working professionals, with state-of-the-art knowledge delivered by Software Engineering faculty, to provide students with core foundations that link to modern software engineering practice, and
4. Connects students to world-renown experts in software engineering throughout their four years of study.

Approximately 40 North American universities offer a B.S. Degree in Software Engineering; 23 of these programs are accredited as of Fall 2015. No Big Ten universities offer an undergraduate degree program in Software Engineering (see Table C). Within the member states of the Midwestern Higher Education Compact, five ABET accredited Software Engineering programs are currently offered: (1) Iowa State University, Ames, IA, (2) Milwaukee School of Engineering, Milwaukee, WI, (3) Rose-Hulman Institute of Technology, Terre Haute,

IN, (4) University of Michigan – Dearborn, Dearborn, MI, and (5) University of Wisconsin – Platteville, Platteville, WI.

Of these five institutions, Iowa State University (ISU) is the only other university with a strong research program in Software Engineering. Our program differs from the program at ISU in two important ways: 1) the ISU program largely follows a Computer Science curriculum with the addition of software engineering courses, whereas our Software Engineering curriculum was designed to teach foundational topics traditionally taught in first year Computer Science courses, e.g., CS 1 and CS2, with a software engineering focus, and 2) our Software Engineering program requires a two-year capstone, whereas students in the ISU Software Engineering program are required to take a one-year capstone.

E. Consistency with the Comprehensive Statewide Plan for Postsecondary Education

The proposed major meets the goals outlined in the Comprehensive Statewide Plan for Postsecondary Education by the Nebraska Coordinating Commission for Postsecondary Education (CCPE). CCPE wants to ensure that postsecondary education develops graduates who can both contribute to and succeed in a high technological world. The proposed Software Engineering major strengthens that goal in several ways:

1. Meeting the needs of students by increasing participation and access of students to education and training in software engineering by recruiting students across the State and across the nation regardless of economic status, age, culture, disability, color, national origin, or gender.
2. Meeting the needs of students by providing graduates of the proposed program with the skills, knowledge, and critical thinking skills necessary to succeed in the field of software engineering, and to be responsible citizens and leaders in their field through the ethical, competent and creative practice of software engineering in industry, academia and the public sector.
3. Meeting the needs of the State of Nebraska by providing workforce development and ongoing training in the field of software engineering in order to provide employers and industries in both urban and rural areas of the State with knowledgeable, trained and skilled software engineers.
4. Contributing to the health and prosperity of the people of Nebraska and the vitality of the State through research and development efforts, technology transfer and technical assistance by preparing graduates of the program to become technology leaders who create new products and services and who help facilitate the technology achievements of others.
5. Adopting new teaching methods and technologies to address the evolving needs of students who have grown up with technology and are seeking an innovative and experience-based curriculum to study a rapidly evolving engineering discipline.
6. Meeting accountability, effectiveness, and partnership goals by developing and sustaining exemplary teaching, learning, research and public service activities through faculty coordination with peers and with organizations that rely on technology to meet their objectives.

- [1] Software Engineering 2014 Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering, The Joint Task Force on Computing Curricula, IEEE Computer Society, and Association for Computing Machinery, SE2014 Revision, 23 February 2015.
- [2] <http://www.bls.gov/ooh/Computer-and-Information-Technology/Software-developers.htm>
- [3] http://www.bls.gov/oes/current/oes_30700.htm
- [4] Guide to the Software Engineering Body of Knowledge (SWEBOK) V3.0, Bourque, P. and Fairley, R., editors, IEEE Computer Society, 2004.
- [5] http://www.payscale.com/research/US/Job=Software_Engineer/Salary/4fd947de/Entry-Level

ADDENDUM A: Relationship of the Proposal to the NU Strategic Framework

The proposed major in Software Engineering matches the spirit of the following passages from the University's 2014-2016 Strategic Planning Framework:

1. The University of Nebraska will provide the opportunity for Nebraskans to enjoy a better life through access to high quality, affordable undergraduate, graduate and professional education.
 - a. The university will strive to increase affordability and ensure qualified students are not denied access based on economic circumstances.
 - b. Increase the percentage of Nebraska high school graduates (the state "college-going rate") who enroll at and graduate from the university.
 - c. Increase the diversity of those who enroll at and graduate from the university, employing measures permitted by state and federal law.
 - e. Promote adequate student preparation for success in higher education.
 - f. Promote ease of transfer to the university from other higher education institutions.
2. The University of Nebraska will build and sustain undergraduate, graduate and professional programs of high quality with an emphasis on excellent teaching.
 - a. Recruit and retain exceptional faculty and staff, with special emphasis on building and sustaining diversity.
 - c. Provide opportunities for global engagement of faculty through international teaching, research and outreach exchanges, fellowships and collaborations.
3. The University of Nebraska will play a critical role in building a talented, competitive workforce and knowledge-based economy in Nebraska in partnership with the state, private sector and other educational institutions.
 - a. Work to stem and reverse the out-migration of graduates and knowledge workers.
 - b. Increase proportion of the most talented Nebraska high school students who attend the University of Nebraska.
 - c. To attract talent to the state, increase the number of nonresident students who enroll at the university.
 - d. To adequately prepare students for the global economy, significantly increase opportunities for international study and engagement.
 - f. Develop and strengthen internship and service learning opportunities with business, education, government, military, and nonprofit organizations.
 - g. Engage in partnerships with government and the private sector to develop regional economic strength.
 - h. Pursue excellence in educational attainment aligned with the long-term interests of the State.
4. The University of Nebraska will pursue excellence and regional, national and international competitiveness in research and scholarly activity, as well as their application, focusing on areas of strategic importance and opportunity.
 - a. Increase external support for research and scholarly activity.
 - b. Increase undergraduate and graduate student participation in research and its application.

5. The University of Nebraska will serve the entire state through strategic and effective engagement and coordination with citizens, businesses, agriculture, other educational institutions, and rural and urban communities and regions.
 - a. Support economic growth, health and quality of life through policy initiatives consistent with university mission.
 - b. Recognize and reward faculty innovation and effectiveness in outreach and engagement.
 - c. Support Nebraska's economic development.
 - d. Support entrepreneurship education, training and outreach.
 - e. Collaborate with the public and private sectors to build successful regional, multi-state, international linkages.

ADDENDUM B: Description of Software Engineering Major

1. Student Learning Outcomes

The Joint Task Force on Computing Curricula has identified a number of expected student outcomes for an undergraduate curriculum in Software Engineering.² These complement the general ABET accreditation outcome requirements applicable to all engineering programs and the accreditation requirements specific to Software Engineering programs.

According to Software Engineering curricular guidelines, graduates of an undergraduate Software Engineering program should be able to demonstrate the following qualities:

- **Professional Knowledge:** Show mastery of software engineering knowledge and skills and of the professional standards necessary to begin practice as a software engineer.
- **Technical Knowledge:** Demonstrate an understanding of and apply appropriate theories, models, and techniques that provide a basis for problem identification and analysis, software design, development, implementation, verification, and documentation.
- **Teamwork:** Work both individually and as part of a team to develop and deliver quality software artifacts.
- **End-User Awareness:** Demonstrate an understanding and appreciation of the importance of negotiation, effective work habits, leadership, and good communication with stakeholders in a typical software development environment.
- **Design Solutions in Context:** Design appropriate solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.
- **Perform Trade-Offs:** Reconcile conflicting project objectives, finding acceptable compromises within the limitations of cost, time, knowledge, existing systems, and organizations.
- **Continuing Professional Development:** Learn new models, techniques, and technologies as they emerge and appreciate the necessity of such continuing professional development.

We adopt these outcomes as central to our proposed Software Engineering major. Outcome assessments will include regular and ongoing course and curriculum assessment, based on student course evaluations, published benchmark standards, examination results, feedback from industrial employers, and faculty review of the curriculum. Both the feedback from these sources and the revisions implemented as a result of the feedback will be documented.

2. Admission Criteria and Selection Procedures

Admission criteria and selection procedures will:

- Seek students who demonstrate analytical capabilities.
- Emphasize equity by assuring no constraints due to economic status, age, culture, disability, color, national origins, or gender.
- Seek to link student applicants to financial support enabling them to obtain their degree.

² The Joint Task Force on Computing Curricula, IEEE Computer Society, and Association for Computing Machinery, Software Engineering 2014 Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering, SE2014 Revision, 23 February 2015.

The admission requirements for the proposed major in Software Engineering are the same as the admission requirements for the College of Engineering at the University of Nebraska-Lincoln. Once students are admitted to the College, students must go through the Professional Admission Process, which is automatically performed for qualifying students at the end of the sophomore year. In order to be considered for Professional Admission to the Software Engineering program, students must receive at least a C+ in SOFT 160, SOFT 161, SOFT 260, SOFT 261, CSCE 235, MATH 106 and MATH 107 (or their equivalents), and have a GPA of at least 2.5 (semester and cumulative).

3. Coursework Requirements

The coursework for the major in Software Engineering (Bachelor of Science in Software Engineering) consists of 124 credit hours. Seventy-nine hours cover core Computer Science and Software Engineering courses: 52 hours of required coursework (shown below), 15 hours of technical electives, and 12 hours of a two-year capstone course. As an information-based engineering discipline, the proposed software engineering major also requires students to complete 18 hours of coursework in mathematics and 12 hours of science course work, of which at least once science course must include a laboratory. In contrast to physics-based engineering disciplines, the training of Software Engineers calls for a background in mathematics that helps to organize and process representations that characterize potentially large corpuses of data. For this reason, student mastery of techniques from discrete mathematics, linear algebra, probability and statistics is essential. To accommodate courses on these topics, the proposed curriculum eliminates requirements for upper level calculus and differential equations - though they can still be taken as electives. Software Engineering majors take an additional 15 hours of coursework to satisfy Achievement-Centered Education institutional objectives, and are required to take a 1 credit hour internship.

Course Number	Title	Credits	Development
SOFT 160	Software Engineering I	4	New course
SOFT 161	Software Engineering II	4	New course
SOFT 260	Software Engineering III	4	New course
SOFT 261	Software Engineering IV	4	New course
SOFT 360	Software Engineering Mentoring and Leadership	1	New course
SOFT 461	Advanced Topics in Software Engineering	3	Existing course*
SOFT 466	Software Design and Architecture	3	New course
SOFT 467	Testing, Verification and Analysis	3	New course
SOFT 468	Requirements Elicitation, Modeling and Analysis	3	New course
CSCE 10	Introduction to CSE	0	Existing course
CSCE 230	Computer Organization	4	Existing course
CSCE 235	Introduction to Discrete Structure	3	Existing course
CSCE 322	Programming Language Concepts	3	Existing course
CSCE 378	Human-Computer Interaction	3	Existing course
CSCE 411	Data Modeling for Systems Development	3	Existing course
CSCE 423	Design and Analysis of Algorithms	3	Existing course
CSCE 451	Operating Systems Principles	3	Existing course
CSCE 491	Internship in Computing Practice	1	Existing course

**SOFT 461 will be cross-listed with existing course CSCE 461 to avoid naming conflicts with the new Software Engineering course, SOFT 161.*

A sample program of study for the Software Engineering major is shown below.

First Semester	Credits
SOFT 160: Software Engineering I	4
CSCE 10: Introduction to CSE	0
MATH 106: Calculus I	5
Natural Sciences course	4
ACE Student Learning Outcome 5 course	3
Total	16

Second Semester	Credits
SOFT 161: Software Engineering II	4
CSCE 235: Discrete Structures	3
MATH 107: Calculus II	4
Natural Sciences course with Lab	4
Total	15

Third Semester	Credits
SOFT 260: Software Engineering III	4
CSCE 378: Human-Computer Interaction	3
ENGR 20: Sophomore Engineering Seminar	0
Natural Sciences course	4
CSCE 230: Computer Organization	4
Total	15

Fourth Semester	Credits
SOFT 261: Software Engineering IV	4
CSCE 322: Programming Language Concepts	3
CSCE 451: Operating Systems Principles	3
MATH 314: Linear Algebra	3
STAT 380: Statistics and Applications	3
Total	16

Fifth Semester	Credits
CSCE 493: Innovation Lab Project	3
CSCE 411: Data Modeling for Systems Development	3
CSCE 423: Design and Analysis of Algorithms	3
Math/Statistic Elective course	3
JGEN 200: Technical Communication I	3
SOFT 360: Software Engineering Mentoring and Leadership	1
Total	16

Sixth Semester	Credits
CSCE 493: Innovation Lab Project	3
SOFT 461: Advanced Topics in Software Engineering	3
SOFT 466: Software Design and Architecture	3
CSCE/SOFT Technical Elective course	3
CSCE/SOFT Technical Elective course	3
CSCE 491: Internship in Computing Practice	1
Total	16

Seventh Semester	Credits
CSCE 486: Computer Science Professional Development	3
SOFT 467: Testing, Verification and Analysis	3
ACE Student Learning Outcome 6 course	3
CSCE/SOFT Technical Elective course	3
CSCE/SOFT Technical Elective course	3
Total	15

Eighth Semester	Credits
CSCE 487: Computer Science Senior Design Project	3
SOFT 468: Requirements Elicitation, Modeling and Analysis	3
ACE Student Learning Outcome 7 course	3
ACE Student Learning Outcome 9 course	3
CSCE/SOFT Technical Elective course	3
Total	15

To accommodate transfer students from related majors at UNL and other institutions, we will leverage our current advising infrastructure to assess the student's pre-requisite knowledge and determine the proper entry point into the Software Engineering curriculum. A bridge course will be offered to instruct students on the core software engineering topics covered in the first two software engineering courses (SOFT 160 and SOFT 161), thus enabling students to more readily transition between majors during the summer after their Freshman year or prior to their transfer from another college or university.

4. Advising

Advisors are assigned to prospective students through the Engineering Student Services in the College of Engineering. Once admitted into the program, faculty advisors from the major are assigned to help guide students through their degree program and to mentor them for consideration for internship and employment opportunities.

5. Accreditation

The Engineering Accreditation Commission (ABET) accredits undergraduate programs in Software Engineering. We plan to accredit the proposed program. The year for the first visit is to be determined.

APPENDIX A: Letters of Support

Enclosed Letters of Support from Nebraska Companies:

- Pen-Link, P. Kevin Pope, President & CEO; Eric D. Hunzeker, VP, Product Management
- Kiewit Corp., Kris Lappala, Chief Information Officer

Additional Letters of Support from Nebraska Companies (available upon request):

- Nebraska Global, Doug Durham, Principal & CTO
- Fiserv, Jamie Deterding, Senior Vice President
- Hudl, Jon Dokulil, VP of Engineering, Hudl
- Sandhills Publishing, Scott McKinney, Chief Information Officer
- Nelnet, Inc., Mike Dunlap, Chairman; Chuck Norris, Director
- Centrix Solutions, Inc., Tim Schnell, President
- Professional Research Consultants, Inc., José M. "Joe" Inganzo, Owner, President and CEO
- Zillow Group, Inc., Jason Steele, Group Manager

Letters of Support from University of Nebraska-Lincoln

- Dr. Tim Wei, Dean of the College of Engineering
- Dr. Joe Francisco, Dean of the College of Arts & Sciences
- Dr. David Keck, Raikes School of Computer Science and Management



July 20th, 2015

Dr. Matthew B. Dwyer
Leonard A. Lovell Professor of Software Engineering
Chair, Department of Computer Science and Engineering
256 Avery Hall
University of Nebraska
Lincoln, NE 68588-0115

Dr. Dwyer:

We are writing this letter in support of the new UNL Bachelors of Science in Software Engineering program. We feel strongly that several elements of the proposed program help address key challenges that directly impact not only our business, but all other software and information technology businesses in Lincoln and throughout Nebraska.

First, there is a shortage of skilled software engineers. By offering this new and relatively unique undergraduate degree program, UNL is likely to draw more students from around the Midwest and beyond, increasing the overall pool of potential resources. By providing local businesses more opportunities for touchpoints with students throughout their educations in the form of guest lectures, presentations, real world process audits, and internships, we'll likely keep a larger share of that already larger pool of graduating software engineers in Nebraska.

Second, the software engineers we do hire directly out of college are often ill-prepared to be immediately productive. While the traditional computer science curriculum does provide solid software development skills and understanding of theory, there tends to be a lack of understanding and appreciation of software as complex systems, design and architectural patterns, and applied software development and project management processes. A review of the proposed curriculum and our understanding of the opportunities for local software and IT business leaders to participate in the teaching process gives us confidence that this program will be turning out graduates better prepared to hit the ground running.

Finally, computer science and engineering graduates often aren't aware of the amazing career opportunities in software engineering that exist right here in Lincoln and Nebraska. While local companies have the same opportunity to engage and educate undergraduates afforded to the large

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national players, we don't generally enjoy the same top-of-mind branding or notoriety. By providing local software and IT business leaders more and more timely interactions with these students, we are likely to convince many that pursuing software engineering careers right here can be every bit as exciting and even more rewarding, especially when considering cost of living and other quality of life metrics.

In closing, we are excited and encouraged by this new proposed undergraduate program. When the time comes for us to be further involved, do not hesitate to contact us.

Best Regards,

P. Kevin Pope

P. Kevin Pope,
President & CEO

Eric D. Hunzeker

Eric D. Hunzeker,
Vice President, Product Management

5936 VanDervoort Drive • Lincoln, NE 68516 • 402.421.8857 • Fax 402.421.9287 • penlink.com

DATE: July 19, 2015

TO: Mathew Dwyer

FROM: Kris Lappala - Chief Information Officer – Kiewit Corp.

COPY: Jake Macholtz – Vice President of Technology

SUBJECT: University of Nebraska Lincoln - Proposed Software Engineering Program

I am writing this letter to offer strong support for the proposed bachelors of science in software engineering program at the University of Nebraska-Lincoln. As a Fortune 300 company in Nebraska, Kiewit is similar to the many other large, successful organizations in Omaha and Lincoln that require highly skilled technologists, including effective software developers, to help our businesses run successfully.

This four-year software engineering program would be a significant help to meet the growing demand we face in filling key roles across our organization. We are regularly looking for quality candidates, especially with the unemployment rate for technologists in the region at less than 1%. This challenge is exacerbated by the need for developers to have more than technical skills. They now also need strong communication skills – to convey ideas, listen and relate to others in a team environment.

It takes a comprehensive training program to develop the technology and collaboration skills that our business demands – one that can be offered through strong university programs. The size and complexity of designing and developing software systems can't be taught at a week-long development seminars or training sessions. Developing software solutions in our businesses requires an education that covers the complete development process beyond just coding, such as requirements gathering, systems integration, testing, deployment and day two support.

The lack of qualified technologists in the state has not gone unnoticed. Kiewit and other Fortune 500 companies in Omaha are working closely with the Chamber of Commerce to recruit outside the state to bring top talent to our companies. A program at the University of Nebraska-Lincoln would only help alleviate our challenges and cultivate excellent talent that we can develop at our strong companies in our state.

Kiewit is committed to being a good partner for this proposed university program to help ensure its long-term success. This includes providing input on program curriculum, generating content and materials, and offering internships to ensure we're building the technologists of the future.

Thank you for your strong consideration for this proposal. We have the opportunity to establish a dynamic program that will not only draw top students to the University of Nebraska-Lincoln, but also feed a crucial pipeline to local companies committed to growing our economy and developing generations of outstanding technology talent in Nebraska. I look forward to working with you and advancing this important effort.

Sincerely,



Kris Lappala
Chief Information Officer



DEAN'S OFFICE
COLLEGE OF ENGINEERING

September 18, 2015

To: Ronald Green, Interim Senior Vice Chancellor for Academic Affairs
From: Timothy Wei, Dean College of Engineering
Subject: Support For Creation of New Undergraduate Degree Program - Software Engineering

The College of Engineering supports and is in favor of establishing a BS in Software Engineering degree. The degree will be administered by the Department of Computer Science and Engineering. The degree is consistent with the mission and purpose of COE and will contribute to the overall objectives of the college.

IEEE defines software engineering as "the application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software; that is, the application of engineering to software." Its importance as a field of study and practice has increased significantly since its inception in 1969 as software systems have grown in size and complexity, and as society's reliance on software has grown.

Formally, Software Engineering emerged as a distinct discipline in 2004 when the IEEE and ACM established a body of knowledge for the field that is distinct from Computer Engineering and Computer Science. At that time ABET began accrediting degree programs in Software Engineering and today, 22 such programs exist across the country. The trend for degree programs in Software Engineering is on the upswing with several research-intensive universities working to add them, e.g., UC Irvine, Arizona State. UNL would be the first Big Ten university to establish such a program.

As a field of study, Software Engineering fits within the College of Engineering because of its focus on rigorous fundamentals, broad training of engineers who can communicate and connect with other disciplines, and in-depth practical training.

The US Bureau of Labor and Statistics projects very strong growth in employment nationwide in software engineering with especially strong growth in Nebraska. Their recent survey of businesses estimates a need for at least 160 new software engineers for each of the next 7 years. These are attractive and well-paying jobs, with starting salaries of more than \$70,000, and there is latent demand for a program here in Nebraska. Evidence for that demand can be seen by the fact that Iowa State University's Software Engineering program recruits more than 20 students per year from the Omaha area.

Local industry support for this program is strong; more than 18 local companies have stepped forward to help create an innovative program that will help address the acute shortage of software engineers. These companies are working to create a local technology council that will provide opportunities for students to connect with working professionals both in the classroom, through internships, and more broadly through mentoring. This has great potential to create high-levels of student retention and good student job placement.

The strong UNL Software Engineering research program, recently ranked in the top-5 world-wide, will enable UNL to create an innovative program, combining the latest best practices in research-based instructional methods with hands-on experience through real-world projects and internships. Leveraging state-of-the-art equipment and facilities, the new SE program will deliver the foundations and skills necessary to produce a highly-trained workforce for Nebraska's burgeoning technology sector. I expect the program to grow quickly and to establish itself as a national model that draws hundreds of students from the region to Lincoln.

114 Othmer Hall | P.O. Box 880842 | Lincoln, NE 68588-0642 | (402) 472-3181 | Fax (402) 472-7792

September 21, 2015

Dear Colleagues:

I write in support of the Software Engineering major as developed by the Department of Computer Science and Engineering, a shared academic unit between the College of Arts & Sciences and the College of Engineering. While this particular major would reside in the College of Engineering only, the shared unit (CSE) follows the curriculum processes of both colleges. CSE personnel have consulted with and kept the Arts & Sciences Dean's Office and the Arts & Sciences Academic and Career Advising Center informed of the plans for the major. We have worked together to ensure that all of the programs of study currently offered by CSE will continue to run smoothly for students as CSE brings this new major online.

I appreciate this opportunity to support the work of the CSE faculty.

Sincerely,



Joseph S. Francisco
Dean
Elmer H. and Ruby M. Cordes Chair in Chemistry
University of Nebraska-Lincoln
College of Arts & Sciences

August 2, 2015

Re: Letter of Support for Software Engineering Major

Dear Professor Dwyer,

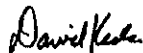
On behalf of the Jeffrey S. Raikes School faculty, I wish to express my enthusiastic support for Computer Science and Engineering's initiative to introduce a software engineering major. We believe that a software engineering major will further strengthen our School's educational offering and enhance our attractiveness to top students across the nation. We expect that within a few years, the majority of our students will, in fact, be software engineering majors. We have already begun the process of enhancing our curriculum so that the Raikes School remains a strong and supportive partner to Computer Science and Engineering.

For more than a decade, the Raikes School, along with its academic partners in business and computer science, has provided a curriculum that has emphasized applied computing and software development, as well as management insight, leadership, and team skills. We believe that the proposed software engineering major will reflect much of what has been learned and what has led to the renowned success of our graduates. This new major will make the learning experience much more widely available at UNL and position UNL strongly to meet the rapidly expanding nationwide demand for skilled software professionals.

This software engineering major initiative is coincident with the rapid expansion of our Design Studio software engineering capstone course for junior and seniors. Our leadership role in the NSF *Pathways to Innovation* program has resulted in emerging collaborations with the College of Engineering and the College of Business and focused on innovation, entrepreneurship, and interdisciplinarity. We believe that an influx of new software engineering students will greatly enhance this related initiative as well and believe that the outcomes will be quite exciting for UNL.

We are quite enthusiastic about being a key partner to this important initiative. I have no doubt that the resulting programs, student outcomes, and interdisciplinary collaborations will result in an even stronger UNL!

Sincerely,



David Keck
Director

APPENDIX B: Credit Hour Justification

The University of Nebraska Board of Regents Policy on the Baccalaureate Degree (RP-5.1.4) states the following:

1. Purpose

The University of Nebraska adopts the following policy to ensure that students have the opportunity to graduate in four years, if they take 15 hours in each of eight semesters.

2. Policy

The University of Nebraska baccalaureate degree shall require 120 credit hours.

3. Exceptions to the Policy

- a. Exceptions to the 120 hour baccalaureate degree shall be approved by the Provost and reported to the Board of Regents if any of the following criteria are documented.
 - 1) Professional accreditation requires more credits for licensing than can be completed to meet standard graduation requirements.
 - 2) A degree is governed by State requirements for certification that require more than 120 hours to meet standard graduation requirements.
 - 3) The degree is defined as a five-year degree.
- b. Any other exception to the 120 credit hours baccalaureate degree must be approved by the Board of Regents of the University.

4. Procedure

This policy will be required for students first entering the University in the fall of 2012. Students previously enrolled may be eligible for the 120 hour degree option.

Reference: BRUN, Minutes, 70, p. 34, (September 9, 2011)

Rationale for 124 Credit Hour Software Engineering Baccalaureate Degree

The rationale for this request is three-fold:

- 1) The Accreditation Board for Engineering and Technology (ABET) criteria implicitly result in curricular requirements in excess of 120 credits.
- 2) We have benchmarked our graduation requirements and found that they are consistent with existing 23 ABET accredited Software Engineering programs.
- 3) Over the past few decades, degree requirements for engineering programs have decreased, from a time when an engineering degree was ~150 credit hours over five years to the present day average of ~128 credits.

Details regarding these three points are outlined below.

ABET Criteria

The Software Engineering program is subject to the accreditation criteria prescribed by the Engineering Accreditation Commission of ABET, Inc. These criteria specify minimum credit hour equivalents for math, science, and engineering topics. Further, ABET articulates 11 student outcomes that must be attained by graduates at the time of graduation. This burden, combined with the University of Nebraska-Lincoln (UNL) ACE requirements, requires the Software Engineering program at UNL to establish course requirements satisfying general education and accreditation requirements in excess of 120 credit hours.

Existing ABET Accredited Software Engineering Programs

The proposed Software Engineering program credit hour requirement (124) is consistent with the credit hour requirements of the 23 existing ABET accredited Software Engineering programs offered in the U.S. We note that some of the programs listed below are based on quarter credit hours/units. Four of the 23 existing programs have 120 credit hour requirements, both of which require only a one-semester capstone course (versus the four semester capstone experience described in the proposed program).

<i>School Name</i>	<i>Location</i>	<i>Credit Hours</i>	<i>Notes</i>
Auburn University	Auburn, AL	120	Include only a one-semester capstone experience
California Polytechnic State Univ., San Luis Obispo	San Luis Obispo, CA	187-188	Quarter Units
Clarkson University	Potsdam, NY	120	Requires only a one semester capstone experience
Drexel University	Philadelphia, PA	188	Quarter Credit Hours – one year capstone
Embry-Riddle Aeronautical Univ. – Daytona Beach	Daytona Beach, FL	127	
Fairfield University	Fairfield, CT	132	
Florida Institute of Technology	Melbourne, FL	127	
Gannon University	Erie, PA	134	
Iowa State University*	Ames, IA	128	
Kennesaw State University	Kennesaw, GA	125	
Milwaukee School of Engineering*	Milwaukee, WI	192	Quarter Credit Hours
Mississippi State University	Mississippi State, MS	128	
Monmouth University	West Long Branch, NJ	128	
Montana Tech of the University of Montana	Butte, MT	128	
Oregon Institute of Technology	Klamath Falls, OR	187	Quarter Credit Hours
Pennsylvania State University, The Behrend College	Erie, PA	127	

<i>School Name</i>	<i>Location</i>	<i>Credit Hours</i>	<i>Notes</i>
Rochester Institute of Technology	Rochester, NY	128	
Rose-Hulman Institute of Technology*	Terre Haute, IN	192	Quarter Credit Hours
The University of Virginia's College at Wise	Wise, VA	120	Requires only a one year capstone experience
Univ. of Michigan – Dearborn*	Dearborn, MI	120	Requires only a one year capstone experience
Univ. of Texas at Arlington	Arlington, TX	121+	Additional credits required for "modern and classical languages as required"
Univ. of Texas at Dallas	Dallas, TX	123	
Univ. of Wisconsin-Platteville*	Platteville, WI	127-130	Varies based on course selection

* Denotes programs offered by member states in the Midwestern Higher Education Compact.

Engineering Degree Requirements at UNL

UNL College of Engineering programs have demonstrated an effort to reduce the number of credit hours required for degrees. In the 1950's and 1960's, UNL engineering degrees required up to 150 hours for a BS degree. Since then, the various programs have decreased the number of credit hours required for graduation. The number of credit hours required for the proposed Software Engineering degree is consistent with the credit hour requirements for other Engineering degrees at UNL.

UNL College of Engineering Major	Current Credit Hour Requirements
Agricultural Engineering	131
Architectural Engineering	129
Biological Systems Engineering	134
Chemical Engineering	135
Civil Engineering	130
Computer Engineering (Lincoln)	126
Computer Engineering (Omaha)	133
Construction Engineering	127
Electrical Engineering	126
Electronics Engineering	133
Mechanical Engineering	129
(Proposed) Software Engineering	124

APPENDIX C: Faculty Curriculum Vitae

- Matthew B. Dwyer, Lovell Professor and Chair, Computer Science and Engineering
- Gregg Rothermel, Professor and Jensen Chair of Software Engineering, Computer Science and Engineering
- Sebastian Elbaum, Bessey Professor, Computer Science and Engineering
- Myra B. Cohen, Susan J. Rosowski Associate Professor, Computer Science and Engineering
- Witawas Srisa-an, Associate Professor, Computer Science and Engineering
- Suzette Person, Associate Professor of Practice and Director of Software Engineering, Computer Science and Engineering

Dr. Matthew B. Dwyer is the Lovell Professor and Chair in Computer Science and Engineering at UNL. His research interests are in formal modeling and analysis of software systems. In his career, Dr. Dwyer has published 25 journal and 93 conference papers, all full-length highly-refereed manuscripts. His research has been recognized with some of the highest distinctions in the field, for example, his work has been awarded an NSF CAREER award, the ICSE "Most Influential Paper" in 2010, the SIGSOFT "Impact Paper" award in 2010, and the ACM Distinguished Paper award in 2006 and 2013. He has chaired the top research conferences in the field of Software Engineering, FSE in 2004, ICSE in 2008, and OOPSLA in 2012, and is the editor-in-chief of the top journal in the field, IEEE Transactions on Software Engineering. He has been named an ACM Distinguished Scientist (2007), a Fulbright Research Scholar (2011), and an IEEE Fellow (2013). A 2004 ranking of international scholars in the field of Software Engineering placed him 28th in the world and another ranking in 2009 placed him 9th. He has graduated 9 PhD students, 4 of whom have taken faculty positions, and his classroom teaching has garnered teaching awards in 2010 and 2014. His full curriculum vitae is available at <http://cse.unl.edu/~dwyer/cv.pdf>

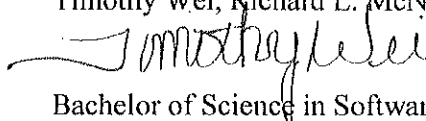
Dr. Gregg Rothermel is the Jensen Chair of Software Engineering and Professor in Computer Science and Engineering at UNL. His research interests are in software maintenance, software testing, end-user software engineering and empirical studies. In his career, Dr. Rothermel has published 50 journal and 98 conference papers, all full-length highly-refereed manuscripts. Dr. Rothermel has chaired the top meetings in software maintenance and testing, ICSM in 2001, ISSTA in 2004, and ICSE in 2007, and is widely known for his influential and pioneering contributions to the field. His research has been recognized with an NSF CAREER award and his h-index, a measure of how widely an author's work is cited, is 64 which ranks him in the top-5 of Software Engineers and in the top-100 of Computer Scientists in the history of those fields. He has been named an ACM Distinguished Scientist (2013) and a 2004 ranking of international scholars in the field of Software Engineering placed him tied for 1st in the world. He has graduated 8 PhD students, 3 of whom have taken faculty positions, and his classroom teaching has garnered teaching awards in 2005 and 2012. His full curriculum vitae is available at <http://cse.unl.edu/~grother/vita.pdf>

Dr. Sebastian Elbaum is a Bessey Professor in Computer Science and Engineering at UNL. His research interests are in system dependability through testing, monitoring, and analysis. Dr. Elbaum has 25 journal publications and over 57 rigorously-reviewed conference publications. He is the recipient of numerous awards, including an NSF CAREER award, IBM Innovation Award, Google Faculty Research Award, and four ACM SigSoft Distinguished paper awards (2006, 2008, 2012, 2013). He has also received many teaching awards, including the Dean's Award for Excellence in Graduate Education from UNL Graduate Studies in 2009. He is internationally recognized in the field of software engineering, serving on various steering committees and organizing committees. He recently served as Program Co-Chair of ICSE in 2015. He is Co-Editor for the Information and Software Technology Journal and he is a member of the ACM Transactions on Software Engineering and Methodologies Journal editorial board. He recently co-founded the Nebraska Intelligent Mobile Unmanned Systems (NIMBUS) lab at UNL, where the latest research in software and systems engineering is applied to robotics and sensor networks to develop more capable and dependable UAVs. Dr. Elbaum has graduated 3 PhD students and 25 M.S. students. His full curriculum vitae is available at <http://cse.unl.edu/~elbaum/content/wp-content/uploads/bioelbaumJuly2014.pdf>

Dr. Myra B. Cohen is a Susan J. Rosowski Associate Professor in Computer Science and Engineering at UNL. Her research interests are in testing of highly-configurable software, testing software product lines and search based software engineering. Dr. Cohen has 11 journal publications and 54 conference and workshop publications. She holds a distinct position at UNL, by becoming the first junior faculty member to receive both the prestigious National Science Foundation CAREER Award, and the Air Force Office of Scientific Research Young Investigators Research Program Award. She was also selected as one of 12 junior faculty from across the US to serve on the DARPA funded Computer Science Study Group in 2009. She regularly publishes in top tier software engineering venues such as ICSE, FSE, ASE and ISSTA, and received an ACM-SIGSOFT Distinguished paper award at FSE in 2015. She also received an ICSE Best Software Engineering in Practice paper award in 2014. Dr. Cohen is an active member of the software engineering research community, having served on numerous program committees, and conference organizing and steering committees. She was the program co-chair of ISSRE in 2012, and served as the general chair of the IEEE/ACM 2015 Automated Software Engineering Conference (ASE). Dr. Cohen has graduated 2 PhD students and 13 M.S. students since her arrival at UNL in 2004. She regularly includes undergraduates in her research and has publications with several of them. Her full curriculum vitae is available at <http://cse.unl.edu/~myra/CohenCV.pdf>

Dr. Witawas Srisa-an is an Associate Professor in Computer Science and Engineering at UNL. His research interests are in embedded systems, programming languages, and operating systems. In his career, Dr. Srisa-an has published 12 journal and 35 conference papers, all full-length highly-refereed manuscripts. His research program has been funded by competitive grants from NSF, AFOSR, NSA, and DARPA. Dr. Srisa-an has served on the program committee for several top scientific meetings in the field of programming languages, ISMM in 2012, OOPSLA in 2012, and ECOOP in 2016. He has graduated 3 PhD students, 1 of whom has taken faculty positions, and his classroom teaching has garnered teaching awards in 2003, 2004, 2005, 2006, and 2008. His full curriculum vitae is available at http://cse.unl.edu/~witty/CV/witty_CV.pdf

Dr. Suzette Person is an Associate Professor of Practice in Computer Science and Engineering, and Director of Software Engineering at UNL. Dr. Person has over 15 years of industry experience as a software engineer. She most recently worked as a Research Computer Scientist at NASA Langley Research Center where her research focused on software testing techniques, and techniques for analyzing the impact of software changes. Dr. Person has two NASA Invention Disclosures, 2 journal publications, and 18 rigorously-reviewed conference publications related to her research, many of which are published in top-tier venues. She received an ACM-SIGSOFT Distinguished paper award in 2006. Dr. Person was a member of the Reinvent Computer Science Curriculum project at UNL in 2003-2004, and co-authored 4 papers related to innovations in computer science curriculum. She is also one of the authors of Bug Hunt, an on-line teaching activity to assist Learning of Software Testing in CS 1 and CS 2. Her full curriculum vitae is available at <http://cse.unl.edu/~sperson/PersonCV.pdf>

Date: January 19, 2016
To: Susan Fritz, Executive Vice President & Provost
From: Timothy Wei, Richard L. McNeel Professor and Dean

RE: Bachelor of Science in Software Engineering

On behalf of the College of Engineering (CoE), I am writing to request that the proposed Bachelor of Science in Software Engineering (SE) program be exempt from the 120 credit hour limit.

As with the other undergraduate programs in the College, CoE plans to seek accreditation for the new program through the Engineering Accreditation Commission (EAC) of ABET. The ABET criteria specify minimum credit hour requirements for math, science, and engineering topics. Further ABET articulates 11 student outcomes that must be attained by students at the time of graduation. This burden, combined with the University of Nebraska-Lincoln Achievement Centered Education (ACE) requirements, requires the proposed Software Engineering program to establish course requirements satisfying general education and accreditation requirements in excess of 120 credit hours as explained below.

Curriculum requirements for all ABET accredited engineering programs include a) one year of a combination of college level math and basic sciences, some of which include experimental experience, b) one and one-half years of engineering topics, and c) a general education component that complements the technical content. One year is considered to be the lesser of 32 semester hours or one-fourth of the total credits required for graduation. ABET also requires a major design experience. The ABET criteria specific to software engineering require breadth and depth across the range of engineering and computer science topics, including

"...computing fundamentals, software design and construction, requirements analysis, security, verification and validation; software engineering processes and tools appropriate for the development of complex software systems; and discrete mathematics, probability, and statistics, with applications appropriate to software engineering."

To meet the ABET math and science requirements, the proposed software engineering program includes 30 hours of coursework in math and science.

Required Math & Science (ABET requires 1 year)	Credits Hours
• Natural Sciences courses with lab (students choose from list)	12
• Calculus I & II	9
• Linear Algebra	3
• Statistics and Applications	3
• Math/Statistics Elective	<u>3</u>
TOTAL	30

The SE proposed program also includes 45 credit hours of software engineering coursework.

Required Software Engineering (ABET requires 1.5 years)	Credit Hours
• Software Engineering I-IV	16
• Software Engineering Leadership and Management	1
• Human-Computer Interaction	3
• Advanced Topics in Software Engineering	3
• Software Design and Architecture	3
• Testing, Verification and Analysis	3
• Requirements Elicitation, Modeling and Analysis	3
• Innovation Lab Project*	6
• Computer Science Professional Development*	3
• Computer Science Senior Design Project*	3
• Internship in Computing Practice	<u>1</u>
TOTAL	45

*Also intended to satisfy ABET major design project experience requirement

Thirty-four (34) hours of breadth and depth courses across software engineering and computer science are required in the proposed software engineering program, including 15 hours of upper-level technical elective courses:

Breadth and Depth Coursework	Credit Hours
• Discrete Structures*	3
• Computer Organization	4
• Programming Language Concepts	3
• Operating Systems Principles	3
• Data Modeling for Systems Development	3
• Design and Analysis of Algorithms	3
• Technical Electives (300-400 level courses)	<u>15</u>
TOTAL	34

*Has historically counted towards math and science required by ABET

The total number of credit hours to achieve the technical component of the program to align with ABET accreditation requirements is 109.

The UNL Achievement Centered Education (ACE) program identifies 10 learning outcomes that all graduates of UNL must attain. These outcomes are composed of: writing, communication, mathematical reasoning, science, humanities, social sciences, arts, ethics, civics, and integrated product development. The proposed SE curriculum covers three of the 10 outcomes as a matter of course, i.e., mathematical reasoning, science, and integrated product development. The remaining seven outcomes would require an additional 21 credit hours, but we have developed approaches to integrate two additional outcomes, e.g., ethics and communication, into courses required for the SE major. This has resulted in the need for students to take only 15 additional credits beyond the SE major-specific courses to achieve the ACE outcomes. The combination of 109 SE major-specific credits and the tailored approach to ACE outcomes, which requires an additional 15 credits, yields the total of 124 credit hours for the proposed SE major. We believe that reducing the number of credit hours to meet the 120 credit hour limit would impact the quality of the program and has the potential to jeopardize future program accreditation or the ability of the program to meet UNL ACE requirements.

Cc: Ronnie Green, Interim Sr Vice Chancellor for Academic Affairs
David Jackson, Associate Vice President for Academic Affairs
David Jones, Associate Dean for Undergraduate Programs, College of Engineering

TABLE 1: PROJECTED EXPENSES - Bachelor of Science in Software Engineering

	FY 2016 Year 1		FY 2017 Year 2		FY 2018 Year 3		FY 2019 Year 4		FY 2020 Year 5		Total Cost
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	
Personnel¹											
Faculty ²	3	\$338,400	3	\$348,552	3	\$359,009	3	\$369,779	3	\$380,872	\$1,796,612
Professional	0		0		0		0		0		\$0
Graduate assistants ³	2	\$56,668	2	\$58,368	4	\$120,892	4	\$124,876	4	\$129,012	\$489,816
Support staff ⁴	1	\$58,500	2	\$164,255	2	\$169,183	2	\$174,258	2	\$179,486	\$745,682
Subtotal	6	\$453,568	7	\$571,175	9	\$649,083	9	\$668,913	9	\$689,370	\$3,032,109
Operating											
General Operating ⁵		\$15,000		\$15,000		\$15,000		\$15,000		\$15,000	\$75,000
Equipment											\$0
New or renovated space											\$0
Library/Information Resources											\$0
Other											\$0
Subtotal		\$15,000		\$15,000		\$15,000		\$15,000		\$15,000	\$75,000
Total Expenses		\$468,568		\$586,175		\$664,083		\$683,913		\$704,370	\$3,107,109

¹Yearly personnel expenses are increased by 3% annually for years 2-5 from the year 1 baseline.

²Funds to hire two Assistant Professors (estimated starting salary \$90K-\$95K) and one Assistant Professor of Practice (estimated starting salary \$72K-\$76K), plus benefits. In addition to the new hires, the current SE faculty allocate a portion of their teaching capacity to the new program, e.g., offerings of SE courses in CS and CE will be reduced and that capacity directed to this new SE degree program.

³ Hire two Graduate Teaching Assistants (GTAs) to support in-class lab-based instruction, an additional two GTAs will be hired as the program builds out.

⁴Hire an entry level computing staff member to exclusively support undergraduates (laptop setup, infrastructure, etc.). In year 2, hire a staff member to support the capstone courses required during Junior and Senior years of program.

⁵Operating budget will be used for recruiting, outreach, industry programs, and day-to-day operations specific to the new Software Engineering program.

TABLE 2: REVENUE SOURCES FOR PROJECTED EXPENSES - Bachelor of Science in Software Engineering

	FY2016 Year 1	FY2017 Year 2	FY2018 Year 3	FY2019 Year 4	FY2020 Year 5	Total
Allocated UNL Funds for CSE ¹	\$395,068	\$ 406,920	\$ 419,128	\$ 431,701	\$ 444,653	\$2,097,470
Required New Public Funds						
1. State Funds						
2. Local Tax Funds (community colleges)						
Gross Tuition/Gross Differential Tuition ²	\$404,131	\$990,884	\$1,600,945	\$2,235,012	\$2,456,358	\$7,687,330
Other Funding						
Total Revenue	\$799,199	\$1,397,804	\$2,020,073	\$2,666,714	\$2,901,010	\$9,784,800

¹ UNL's Senior Vice Chancellor for Academic Affairs has allocated funds for one Asst. Professor of Practice position, two new Asst. Professor hires, and two Teaching Assistants. Yearly personnel expenses are increased by 3% annually for years 2-5 from the year 1 baseline. As program growth requires, additional hires will be supported with college tuition and differential tuition allocations.

² Gross tuition estimates are based on the table below.

Projected Tuition Revenue												
Student Type ¹	Year 1		Year 2		Year 3		Year 4		Year 5			
	R	N	R	N	R	N	R	N	R	N	R	N
Estimated Gross Tuition ²	\$8,693.44	\$25,584.69	\$8,867.31	\$26,096.38	\$9,044.65	\$26,618.31	\$9,225.55	\$27,150.68	\$9,410.06	\$27,693.69		
Estimated Enrollment ³	29		69		109		149		160			
Est. Enrollment by Type	20	9	47	22	74	35	101	48	108	52		
Estimated Gross Tuition	\$173,868.75	\$230,262.19	\$416,763.39	\$574,120.39	\$669,304.28	\$931,640.81	\$931,780.09	\$1,303,232.40	\$1,016,286.08	\$1,440,071.80		
Est. Total Gross Tuition Revenue	\$404,130.94		\$990,883.78		\$1,600,945.09		\$2,235,012.49		\$2,456,357.89			

Est. 5 Year Gross Tuition Revenue

\$7,687,330.18

¹ R=Resident, N=Non-Resident

² Tuition estimates include differential tuition for CSCE and SOFT courses; annual tuition increases of 2% are used for years 2-5.

³ Expected steady state enrollment, by year 5, is 160 students (40 in each class).

June meeting

March 21, 2016

Dr. Michael Baumgartner
Executive Director
Coordinating Commission for
Postsecondary Education
140 N. 8th Street, Suite 300
Lincoln, NE 68509

RECEIVED
MAR 21 2016
Coordinating Commission
for Postsecondary Ed.

Dear Michael:

Enclosed is a copy of the proposal to create a Bachelor of Science in Software Engineering in the Department of Computer Science and Engineering in the College of Engineering at UNL. The proposal was approved by the Board of Regents at the March 18, 2016 meeting. Also enclosed is the Proposal for New Instructional Program Form 92-40.

Please do not hesitate to contact me if you have any questions.

Sincerely,



Susan M. Fritz
Executive Vice President and Provost

Enclosure

c: Chancellor Harvey Perlman
Interim Senior Vice Chancellor Ronnie Green
Dean Timothy Wei, College of Engineering
Associate Vice President David Jackson

TO: The Board of Regents
Academic Affairs

MEETING DATE: March 18, 2016

SUBJECT: Creation of a Bachelor of Science (BS) in Software Engineering in the Department of Computer Science and Engineering in the College of Engineering at the University of Nebraska-Lincoln (UNL)

RECOMMENDED ACTION: Approval is requested to create a Bachelor of Science in Software Engineering in the Department of Computer Science and Engineering in the College of Engineering at UNL

PREVIOUS ACTION: March 12, 1988 – The Board approved the reorganization of the Department of Computer Science into the Department of Computer Science and Engineering at UNL.

EXPLANATION: Software engineering as a field of study and as a profession has grown significantly over the last several years. Today, 22 degree programs exist in the U.S. and several research-intensive institutions are working to add them. UNL would be the first Big Ten university to create a specific software engineering undergraduate major.

Faculty involved in UNL's strong software engineering research program will create an exceptional undergraduate program that will graduate highly-trained software engineers that are in demand nationally and in Nebraska. Because of such demand, it is expected that the program will grow very quickly and will attract many students across the region to UNL. The program will seek ABET accreditation. The Executive Vice President and Provost has determined, like most UNL engineering programs, that accreditation standards coupled with UNL's general education requirements cannot be met within a 120 credit hour program. The BS in Software Engineering will require 124 credit hours.

This proposal has been reviewed by the Council of Academic Officers. This proposal also has been reviewed and recommended for approval by the Academic Affairs Committee.

PROGRAM COST: \$3,107,109 over 5 years (details on proposal page numbers 37 and 38)

SOURCE OF FUNDS: Resources committed to the College of Engineering from UNL's Senior Vice Chancellor for Academic Affairs will support the new faculty hires and teaching assistants. Current College of Engineering funding will be used to support operating expenses; as program growth allows, additional needs will be met using tuition and currently approved differential tuition allocations.

SPONSORS:

Ronnie Green
Vice President, Agriculture and Natural Resources, University of Nebraska
Interim Senior Vice Chancellor for Academic Affairs
Harlan Vice Chancellor, Institute of Agriculture and Natural Resources,
University of Nebraska-Lincoln

Harvey Perlman, Chancellor
University of Nebraska-Lincoln

RECOMMENDED:



Susan M. Fritz
Executive Vice President and Provost

DATE:

February 26, 2016